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AWARENESS ABOUT THE HEALTH IMPACTS OF INDOOR AIR POLLUTION ON RURAL WOMEN IN DISTRICT FAISALABAD

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Indoor concentrations of pollutants depend on the quantity of emissions, the volume of the polluted space and the rate of exchange between indoor and outdoor air. The principal indoor pollutants vary in rural and urban areas but they are a source of disease everywhere. Women are particularly at risk for a variety of adverse health effects related to indoor air pollution. Middle ear infection, tuberculosis, perinatal mortality (still births and death in the first week of life), low birth weight, eye irritation, cataract, asthma and oral cancer have all been associated with indoor smoke. For this purpose a study was conducted in rural areas of District Faisalabad which aims to assess the awareness/ knowledge about the health impacts of indoor air pollution on rural women. The sampling was consisted on four stages. At the first stage two tehsils were selected randomly from the Faisalabad District. At the second stage two union councils were taken from each tehsil through simple random sample technique. At the third stage two villages, from each union council were selected randomly and at the fourth stage 30 women from each village were taken purposively. The total sample size of women was 240. It was found that that the awareness of people about the adverse implications of the emission of bio-mass on their health particularly women and children who are more exposed to kitchen environment in terms closed and opened kitchen and its location, duration spent for cooking, types of fuel and stove is recommended.
Keywords: Awareness, health impacts, indoor pollutants, rural women, Faisalabad

INTRODUCTION

Cooking energy has the major share in total household energy consumption. Accessibility and availability of cooking fuels at affordable prices is becoming more difficult day by day for poor people. Many of whom are outside the modern energy system. Cooking fuels in the rural areas of Pakistan are predominantly unprocessed bio-fuels, such as fuel-wood, crop residues and animal dung. The use of these bio-fuels causes, especially to women, much hardships which in economic terms are negative externalities (Barnes and Sen, 2000). The role of women in household activities (including livestock care) in rural areas of the country has been very significant (Riasat *et al*., 2014).

Many countries in all over the world have produced quantitative estimation of fuel but misfortune is that especially the developing countries have little knowledge about their risk level like Pakistan. Solid fuels are also used in human service industry. In underdeveloped countries due to limited resources they entirely depend on the biomass or solid fuels to fulfill energy demand and the rate of consumption is 100% (World Resources Institute, 2003). Indoor air pollution depends on a variety of factors including household energy technology such as the existence of a chimney and the fuel-stove combination, housing area, housing characteristics such as the number of rooms and ventilation and behavioral determinants such as the amount of time spent inside the house (Ezzati and Kammen, 2001). The principal indoor pollutants vary in rural and urban areas and in developing and industrialized countries but they are a source of disease everywhere (Padilla *et al.*, 2010).

In under developed and developing countries women and children cannot avoid unnecessary exposure of biomass smoke. It is world's culture that women play primary role in cooking and distribution of food for her family (Bishokarma and Amir, 2014). Some young daughters start cooking in their early ages to help their mothers in preparing food and almost spent 3 to 7 hours with their mothers in the kitchen. Infants are usually carried out by their mothers and they are equally suspected to chronic diseases due to biomass smoke (Campbell, 2014). As women are primary cooks and look after their children in nearly all cultures they with their children receive the greatest exposure to the smoke from solid fuel combustion. This exposure ultimately leads to higher risks for women as well as children (WHO, 2007).

The health effects of domestic use of biomass fuel and coal are suffered largely by women. Respiratory diseases in women often go untreated due to lack of physical and cultural access to health facilities. Culturally, education of females is a low priority and women's work is centered on domestic activities with most time spent inside the home. At present the available options to reduce the levels of indoor air pollutants are limited in developing countries (Saldiva and Miraglia, 2004).

Moreover, it is found that rural women using biomass fuels 3 times more likely to have tuberculosis than women using cleaner fuels and health of rural women highly associated with her socio-environmental factors (Smith *et al.*, 2000).

Poorest and least educated women have twice the pollution level as compared with high-income and highly educated women. In addition, as it has also been found in the study, poor women are less aware about the health effects of indoor air pollution. More than half of the illiterate women do not have knowledge about this connection (Dasgupta *et al.*, 2004).

Significance of the study: The polluted air inside the kitchen might causes many health problems for women who spend a large part of their day devoted to food preparation duties. As a result, women are more likely to be affected by the smoke generated from the use of un-processed fuels in indoor environment than their male counterparts. This study will help to determine the health risks associated with indoor air pollution. It also determines the knowledge/awareness level among the women about the health impacts of indoor air pollution.

Objectives of the study

1. To determine the socio-economic characteristics of the households.
2. To examine the types of biomass fuel used for burning in the sampled households.
3. To explore the respondents' knowledge about the ill-effects of biomass emission on human health.
4. To explore the hazards/effects of biomass emissions (types, duration of exposure, timing, season, location, area, closed or unclosed environment) on women's health.
5. To examine the respondents' awareness and practices (strategies) how to minimize the ill-effects of biomass emission.

Theoretical Framework

The classic theory of "Energy Ladder": Households at lower levels of income and development tend to be at the bottom of the energy ladder using fuel that is cheap and locally available but not very clean nor efficient (see Figure 1). Three billion people worldwide are at these lower rungs, depending on biomass fuels crop waste, dung, wood leaves, and coal to meet their energy needs. A disproportionate number of these individuals resides in Asia and Africa: an enormous majority (95%) of the population in Afghanistan uses these fuels, similarly, 95% in Chad, 87% in Ghana, 82% in India, 80% in China, and so forth. Coal is seen as a higher quality fuel due to its efficiency and storage and thus is higher on the energy ladder but coal can in fact be dirtier than wood. As income rises one expects that households would substitute to higher quality fuel choices. However, this process has been quite slow. In fact, the World Bank reports that the use of biomass for all energy sources had remained constant at about 25% since 1975 (Holdren and Smith, 2000).

This ladder describes transition in fuel use at different levels of economic development. For those on the lower rungs, cooking with traditional solid fuels on open flames or

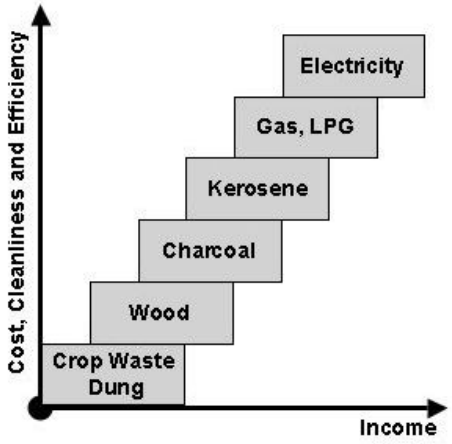

Figure 1. The classical "Energy Ladder"

traditional cooking stoves may result in exposure to extremely damaging toxic pollutants. These pollutants ultimately result in concentration of more than 10 times the permitted EPA level over a 24 hour period (Holdren and Smith 2000).

Application of the theory to present study: In the study researchers explained that the energy-poverty nexus also existed at the individual and household level. The given situation was based upon the economic levels and the poor use a different set of energy carriers more disproportionately and in traditional way than the rich. Researcher also explained that higher level income groups tend to use fuels at higher rungs. Wood, animal dung and crop wastes represent the lowest rung on the energy ladder with charcoal and coal, kerosene, liquefied petroleum gas (LPG), and electricity. These also represent successive rungs up the ladder. So, the rural women use wood, agricultural waste and dung as primary fuels. The increased dependence on the use of wood, crop residues and untreated coal for cooking has a lot of negative implications on both people and environment.

MATERIALS AND METHODS

The universe of present study was District Faisalabad. A multistage sampling technique was used for the selection of areas in District Faisalabad. The sampling was consisted four stages. At first stage two tehsils Jaranwala and Samundri were selected randomly; at second stage two union councils 273-G.B, Samandar Mandi G.B. and 101-G.B., 102-G.B. were taken, respectively, from each of the selected tehsil, respectively, through Simple Random Sampling technique. At third stage two villages, Maduwana and Daudana from 273-G.B., Wahge and Shair Ka Chak from Samandar Mandi selected randomly. Villages 196-G.B and 199-G.B from 101-G.B and 193-G.B and 195-G.B were selected randomly from 102-G.B. At fourth stage 30 women from each village were taken purposively. The total sample size of women was 240. Descriptive analysis was used to describe the socio-

Table 1. Distribution of the respondents according to their socio-economic characteristics

Age (in years)	Frequency	Percentage
Up to 30	77	32.1
31-40	87	36.2
Above 40	76	31.7
Total	240	100.0
Mean	2.00	
Standard Deviation	.800	
Education	Frequency	Percentage
Illiterate	56	23.3
Primary	90	37.5
Middle	54	22.5
Matric or above	40	16.7
Total	240	100.0
Mean	5.34	
Standard Deviation	3.458	
Family type	Frequency	Percentage
Nuclear	53	22.1
Joint	150	62.5
Extended	37	15.4
Total	240	100.0
Mean	1.93	
Standard Deviation	.610	
Total household Income (Rs.)	Frequency	Percentage
Up to 20000	53	22.1
20001 – 30000	139	57.9
Above 30000	48	20.0
Total	240	100.0
Mean	1.98	
Standard Deviation	.650	

Table 2. Distribution of the respondents according to the type of kitchen they have in their house

Type of kitchen	Frequency	Percentage
Open kitchen	95	39.6
Blocked kitchen	47	19.6
Single file kitchen	77	32.1
Double file kitchen	10	4.2
Unfitted kitchen	11	4.6
Total	240	100.0
Mean	2.15	
Standard Deviation	1.131	

Table 3. Distribution of the respondents according to the type of stoves they used in their kitchen n = 240

Types of stove	Yes		No	
	F	P	F	P
Wood stove	114	47.5	126	52.5
Tandoor oven	152	63.3	88	36.7
Rock oven	61	25.4	179	74.6
Mid-brick stove	46	19.2	194	80.8
Mud stove	129	53.8	111	46.2

Table 4. Distribution of the respondents according to their kitchen located at that site where there is any source of ventilation or window for circulation of air

Kitchen with ventilation	Frequency	Percentage
Yes	24	40.0
No	216	60.0
Total	240	100.0
Mean	1.10	
Standard Deviation	.301	

environmental and health conditions of the respondents. Chi-square and Gamma tests were applied to examine the relationship between independent and dependent variables. Multivariate analysis was also carried out to find the relative importance of independent variables in explaining the dependent variable.

RESULTS AND DISCUSSION

Table 1 indicates about one third of the respondents (32.1%) belonged to the age up to 30 years. More than one third (36.3%) of the respondents were having the age between 31-40 years while less than one third (31.7%) of the respondents belonged to the age above 40 years. Table 1 highlights that about one fourth (23.3%) respondents were illiterate, more than one third (37.5%) respondents had completed primary education. Some of (22.5%) the respondents had completed elementary education while only few (16.7%) respondents had completed 10 and more years of education. Islam (2003) indicated that Pakistan is a developing country so its women have to face a lot of health problems particularly in rural areas. It is estimated that about 1,600 women per 100,000 die during childbirth. It is explained that women's literacy rate is very low in Pakistan. It is also found that she suffered a lot during her cooking time in the kitchen due to the use of biomass fuels. Biomass materials are not easy to use. Moreover, socio-economic conditions of rural areas of Pakistan are highly responsible of poor health of women. In 2004-2005 government estimated that nearly 24% of rural population was living below poverty line. Poor socio-economic conditions are due to poor education ratio and it had an ultimate effect on their health. Table 1 reveals that some of (22.1%) respondents had lived in nuclear family. A vast majority of (62.5%) respondents were living in joint family while only 15.4% of the respondents were in extended family. Table 1 shows that some of (22.1%) respondents' family had their income less than 20,000. A vast majority of respondents' family (57.9%) had their income between 20,001 to 30,000 while only one fifth respondents' family had their income above 30,000. Reddy (2001) defined that an energy-poverty nexus exists where dependence on traditional biomass fuels is both a cause and result of poverty while at the same time; poverty prevents the affordability and access to modern fuels. Use of traditional biomass fuel ultimately depend on household income. In developing countries most of rural people cannot afford modern fuels due to limited household income. As a result low income and poverty play a major role for rural people to their dependence on use of traditional biomass fuels.

Children aged 5-9 those whose mothers specialized in home care during pregnancy and in the first year after the child's birth were significantly more likely to have respiratory diseases symptoms. The condition is the exposure to indoor pollutants in homes using biofuels but not in homes using LPN gas.

Table 3 shows that less than half (47.5%) of the respondents were using wood stoves. A vast majority

Table 5. Distribution of the respondents according to their awareness about health risks associated with biomass fuel emission n=240

Health risks/ diseases	Response					
	To a great extent		To some extent		Not at all	
	F	P	F	P	F	P
Chest pain	93	38.8	131	54.6	16	6.7
Breathing problems	145	60.4	87	36.2	8	3.3
Coughing	175	72.9	57	23.8	8	3.3
Asthma	91	37.9	118	49.2	31	12.9
Eye irritation	105	43.8	106	44.2	29	12.1
Allergy	79	32.9	95	39.6	66	27.5
Lung cancer	15	6.2	100	41.7	125	52.1
Cardiac	18	7.5	86	35.8	136	56.7
Pulmonary	20	8.3	68	28.3	152	63.3
T.B.	27	11.2	36	15.0	177	73.8

(63.3%) of respondents used tandoor stoves, about one fourth (25.4%) percent respondents were cooking food with rock ovens. Some of the respondents (19.2%) were using mid brick stoves and more than half (53.8%) of the respondents were having mud oven in their houses. Chretien (2006) found that there are a number of ways to categorize cooking stoves. For some inquiries, it may be appropriate to categorize them by construction material, by the number of pots that can be placed on them or by efficiency. With regard to smoke emissions, perhaps the best categories are those relating to the design of the combustion chamber. Although there are many variations, four models seem to stand out: (a) Open combustion with no combustion chamber at all. Three rocks or bricks for holding the pot above an open fire is the most common example of this type. This arrangement is obviously the cheapest possible and is thus used by poor in all countries: (b) Partly open combustion. Either by digging a shallow pit in the ground or by making a U-shaped hole in a block of clay or bricks, a semi-enclosed combustion chamber is created: (c) Enclosed chamber with clay or metal stoves. These stoves are made from clay or metal or are dug into the ground and have an enclosed combustion chamber but no chimney for inducing natural drafts or for removing smoke. Examples are the Thai bucket stove, the ordinary and improved clay stoves of Pondicherry (India) and the deep pit stove much used in Bangladesh: (d) Enclosed chamber with chimney stoves. These stoves rely on a chimney to create a natural draught through an enclosed combustion chamber and also remove the smoke from the room. Examples are the well-known Magan, Hyderabad, Singer and Lorena smokeless cooking stoves.

Table 4 highlights that less than half (40.0%) respondents' kitchen were at that site where they had source of ventilation or window for the circulation of air. More than half (60.0%) respondents' kitchen were located at that site where they had no any source of ventilation or window for the circulation of air. Pandey (2008) suggested that substantial improvements are expected with the adjustments in cooking "behaviour" and prevailing practices, even with fuel-wood use. These adjustments, such as simple changes in ventilation characteristics of housing (locations and placement of windows and doors, cooking locations, space configuration, construction materials) and ventilation practices (keeping doors and windows open after cooking) can be quite simple. It may be for improving habits to avoid the unnecessarily closeness to the fire and keeping children away from fires. It was estimated that 30% of the burden of disease due to household environment can be reduced just by proper ventilation in kitchens.

Table 5 depicts that more than one third (38.8%) respondents were aware to a great extent about chest pain due to biomass exposure, majority of (60.4%) respondents were aware to a great extent about breathing problems. An over whelming majority (72.9%) of respondents were aware to a great extent about coughing, more than one third (37.9%) respondents were aware to a great extent about asthma. Less than one half (43.9%) respondents were aware to a great extent about eye irritation. Less than one third (32.9%) were aware about allergy, little size (6.2%) were aware to a great extent about lung cancer. Some of (7.5%) were aware to a great extent about cardiac problems, (8.3%) and (11.2%) were aware to a great extent about pulmonary and T.B, respectively. More than half of (54.6%) the respondents were aware to some extent about chest pain due to biomass fuel emission. More than one third (36.2%) were aware to some extent about breathing problems, less than one fourth were aware to some extent about coughing, less than half (49.2%) and (44.2%) were aware to some extent about asthma and eye irritation respectively. More than one third (39.2%) respondents were little about allergy, less than half (41.7%) respondents were somewhat aware about lung cancer, more than one third (35.8%) respondents were little aware about cardiac. More than one fourth (28.3%) respondents were aware to some extent about pulmonary while only (15.0%) respondents were little aware about T.B. Samet (2002) examined that high concentrations of indoor air pollutants lead to a number of adverse health consequences which disproportionately burdenized women and young girls. These consequences include acute lower respiratory tract infections, including sinusitis, otitis media, and pneumonia. Prolonged exposures can cause chronic bronchitis, chronic obstructive pulmonary disease, asthma, upper airway cancers (including nasopharyngeal and laryngeal cancers), cardiovascular disease, pulmonary

arterial hypertension, low birth weight, and perinatal mortality (stillbirths and deaths during the first week of life. Donohoe (2013) expressed that the risk of developing lung cancer from indoor biomass smoke can be 12 times greater than the risk from exposure to similar amounts of environmental tobacco smoke. In total, biomass smoke exposure causes nearly 2 million deaths annually, the loss equivalent to 1 life lost every 20 seconds, or nearly 3% of the global disease burden each year. Exposure to indoor air pollution from biomass smoke interferes with macrophage activity, obstructs cellular membranes and destroys epithelial cells lining the respiratory tract. All of which increase the risk for pulmonary infections. Smoke can exacerbate symptoms of tuberculosis and confined cooking quarters facilitate transmission of this deadly and increasingly multidrug-resistant infection and mostly the women unaware about all these diseases that are infectious.

Statistical test: Ho = there is no association between kitchen environment and women's health status
H1 = Ho = there is association between kitchen environment and women's health status
Level of significance: = 0.05

Test Statistics to be use: Chi-square

Chi-Square tests and Symmetric measures	Value	Df	Significance
Pearson Chi-Square	34.786	4	.000**
Likelihood Ratio	39.940	4	.000**
Linear-by-Linear Association	1.224	1	.000**
Gamma	.134	-	.000**

Chi Square = highly significant** Gamma = highly significant**

The values of Pearson Chi-Square (34.786) and likelihood ratio (39.940) support highly significant association between kitchen environment and health status of women. The value of Gamma (.134) indicates that there is highly significant positive relationship between kitchen environment and health status of women. There is highly significant relationship between variables. So, the hypothesis that there is a relationship between kitchen environment and health status of women is accepted. Khudadad and Shah (2008) explained that in Pakistan, biomass fuel users usually cook indoors using open fires or poorly working stoves with insufficient ventilation facilities. Moreover, there is a relationship between indoor smoke exposure, kitchen environment, kitchen structure and its ventilation and possible negative health effects on women and children.

CONCLUSION

The study explored the effect of socio-economic, demographic variables on women health. The study revealed that polluted air inside the kitchen might cause many health problems for women who spend a large part of their day devoted to food preparation duties. As a result, women suffered variety of adverse health effects related to indoor air pollution. In which included middle ear infection, tuberculosis, perinatal mortality (still births and death in the first week of life), low birth weight, eye irritation, cataract, asthma, and oral cancer. Poorest and least educated women had twice the pollution level as compared with high-income and highly educated women. Rural women do not have access to use better fuels that expels less smoke. Health and quality of life associated with biomass fuels. Unfortunately, simple household stoves often do not allow enough airflow into and through the stove, limiting the amount of oxygen available for combustion. Through the study it was found in rural areas that biomass fuels often burned inefficiently in open fires, with high emission factors, leading to extremely high levels of indoor and local air pollution. It is many times higher than the limits specified by international standards of ambient air quality. Rural women can get rid of this issue with government attention but in reality it was found a poor attention.

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